VI. UNDERSTANDING AND INCREASING PROGRAM EFFECTIVENESS

As the previous chapters show, the Enhanced I/M program is not achieving the required emission reductions. Program changes are needed to maximize the benefits of the Enhanced I/M program and to meet SIP requirements. The current Enhanced I/M program does not meet emission reduction targets because we have not yet implemented final cut points, the program exempts certain vehicles, and some aspects of the program we assumed in the SIP are not being implemented in practice.

Because the roadside data analysis in Chapter III provides only a snapshot of program performance, that methodology cannot be used to estimate the benefits of options for improving the program. As discussed in Chapter IV, draft EMFAC2000 model predictions compare relatively well with the results of the roadside analysis. Draft EMFAC2000 also provides the capability to project program performance under various scenarios. Therefore, we have used draft EMFAC2000 to estimate the benefits of the current program (with the more stringent October 1999 NOx cut points) and two of the potential program changes to increase effectiveness. All analyses in this chapter are based on draft EMFAC2000.

The most significant options that we expect would have direct, quantifiable emission reduction benefits are:

- More stringent inspection cut points;
- Renewed testing of older cars; and
- A new, more thorough evaporative system check for older cars (i.e., adding a comprehensive evaporative system and liquid leak check element to Smog Check).

In this chapter, we quantify the emission benefits of two scenarios:

- Implementing more stringent cut points, including “Final Cut Points” as specified in the SIP and “Interim Cut Points” which are approximately halfway between current and final cut points; and,
- Expanding the scope of the enhanced program to include pre-1974 vehicles or vehicles less than 4 years old.

We also provide a qualitative discussion of adding a comprehensive evaporative system and liquid leak check element to Smog Check, as well as other potential program changes.

A. Cut Points

Table VI-1 shows the fleet emission rates (based on draft EMFAC2000) if we implemented stricter cut points. The fleet average tables in this chapter (which show the impact of various scenarios in grams per mile) are based on only the light- and medium-duty gasoline vehicle fleet. Although heavy-duty gasoline trucks are subject to

the Smog Check program, they are not subject to loaded-mode testing and provide no additional exhaust benefits under the Enhanced program. Thus, they are not included in the fleet emission rate analysis. The fleet emission rate analyses do not include evaporative emissions.

Table VI-1
Effect of Changing Cut Points on Fleet Exhaust Emission Rate
grams per mile (g/mi)

CUT POINT SCENARIOS	$HC_{exhaust}$	NOx
90 Basic I/M	0.928	0.821
Current Cut Points	0.753	0.692
Interim Cut Points	0.716	0.658
Final Cut Points	0.682	0.631
Final Cut Points with all exempted vehicles included	0.661	0.622

Table VI-2 shows the impact the various cut point scenarios would have on meeting the 1994 SIP commitment. This table includes evaporative emissions. The Enhanced I/M program does not attain 100 percent of the SIP commitment at final cut points with all exempted vehicles included for two main reasons: (1) the 1994 SIP assumed that more communities participated in Enhanced I/M and that heavy-duty gasoline trucks were subject to loaded-mode testing, and (2) we are not achieving all of the evaporative emission benefits assumed in the 1994 SIP.

Table VI-2
Effect of Changing Cut Points[1] on Program Effectiveness

CUT POINT SCENARIOS	HC_{total}	NOx
Current Cut Points	68%	51%
Interim Cut Points	72%	65%
Final Cut Points	77%	76%
Final Cut Points with all exempted vehicles included	80%	79%

[1]Includes both exhaust and evaporative hydrocarbon emissions.

1. More Stringent Cut Points

As can be seen in Tables VI-1 and VI-2, implementing interim cut points would reduce the fleet emission rates by approximately 5 percentage points. This translates into increased program effectiveness – moving us almost 5 percentage points closer to the SIP commitment for hydrocarbons, and almost 15 percentage points closer to the SIP commitment for NOx. (The interim cut points have less of an impact on the SIP effectiveness for total HC than NOx because the effectiveness of reducing evaporative HC remains constant in all of the cut point scenarios.) Implementing final cut points

would almost double the reductions in fleet emission rates and increase the program effectiveness to about 75 percent of the SIP commitment.

While implementing final cut points would move the fleet emission rates closer to the SIP commitment, there would also be other consequences. For example, based on an analysis of the roadside data, at current cut points, we expect a failure rate of approximately 22 percent, while at final cut points we would expect a failure rate of about 50 percent. In addition, the current average repair cost is approximately $130 per failing vehicle. This cost would substantially increase under the final cut points. Pilot studies estimated that repair costs could approach $450 per vehicle under final cut points.

Implementing the interim cut points would be a middle ground between the current and final cut points. We believe that the vehicle failure rate would rise from about 22 percent at current cut points to approximately 30 percent at interim cut points. Repair costs would also increase, but not as dramatically as with the final cut points.

In either scenario, the impact on consumers would be increased. This impact may be partially mitigated by BAR's implementation of an aggressive consumer assistance program providing financial assistance for repairs or vehicle retirement. Under the current repair assistance program, BAR provides up to $450 for vehicle repairs ($75 co-payment by low income qualified consumers and a $250 co-payment by other consumers). Under the vehicle retirement program, BAR pays the consumer $450 to retire a failing vehicle. BAR is considering regulatory changes to reduce the required co-payment for repair assistance, and to increase the amount paid to consumers to retire a failing vehicle.

The keys to a successful smog inspection program are efficient identification of high emitting vehicles and proper and complete repair of those high-emitting vehicles. Increasing cut point stringency would increase the identification of high-emitting vehicles, as well as lead to better repairs of those vehicles. From a program implementation perspective, this is an easy and low cost option to implement. BAR could reduce cut points electronically in one day. One of the key cautions is to ensure that the more stringent cut points do not increase the "error of commission" rate (falsely failing a vehicle that is not "broken") beyond the statutory limit of 5 percent. It should also be noted that U.S. EPA has established final cut points for IM240 systems and compliance with these cut points is required to meet U.S. EPA performance standards. Neither the cut points currently used in California nor the "interim" cut points are as stringent as those envisioned by U.S. EPA.

2. Repair to More Stringent Cut Points

Another approach involves requiring those vehicles that are failed to be fully repaired – the cut points following repair would be more stringent than the standards used initially to inspect the vehicle. For example, the pass/fail cut points for the *initial test* could be set at the interim cut points described above, but those vehicles that fail

the initial inspection could be required to be *fully repaired* to the tighter, final cut points. This option would obtain additional emission reductions without increasing the vehicle failure rate.

The key advantage to this approach is that it achieves additional emission reductions from those vehicles already failing Smog Check, thus increasing repair but not inspection costs. This could help make the program more cost-effective. Further, there is evidence that vehicles that are fully repaired remain repaired for a longer period of time than vehicles that have only been partially repaired to *pass the test.* Finally, this approach would dovetail well with the expanded consumer assistance program being implemented by BAR in which the State co-funds additional repairs via the repair assistance program.

There are two disadvantages to this approach:

1. To implement this option, the BAR-97 and VID software would need a major revision to set the two different sets of cut points, i.e., pass/fail cut points and "repair" cut points. Such a change would require at least one year to implement and there would be a cost associated with the software changes; and

2. Pre-inspection repairs may become more common to avoid the greater cost and/or inconvenience associated with the additional repairs. Pre-inspection repairs may be only *partial* repairs, i.e., just enough to pass the inspection.

B. Vehicle Exemptions

Table VI-3 shows the draft EMFAC2000 predicted fleet emission rates for the Enhanced I/M program under various vehicle exemption scenarios (assuming current cut points). Table VI-4 shows the relative impact on meeting the SIP commitment for the 1973 and older, and the four year old and newer vehicle exemptions. Once again, Table VI-3 does not include evaporative emissions, while Table VI-4 does.

Table VI-3
Estimated Change in Fleet Exhaust Emission Rate
Due to Removing Vehicle Exemptions[1]
grams per mile (g/mi)

VEHICLE EXEMPTION SCENARIOS	$HC_{exhaust}$	NOx
90 Basic I/M	0.928	0.821
Current Program	0.753	0.692
1973 & Older *Not* Exempt (add 500,000 vehicles to program)	0.735	0.689
4-Yr & Newer *Not* Exempt (add 3.8 million vehicles to program)	0.752	0.691

[1] All scenarios shown are for NOx cut points at current levels.

As can be seen in Table VI-3, the impact of the new car exemption on the fleet average emission rate is negligible. Assuming an average $50 dollar inspection cost, the new car exemption of 3.8 million newer vehicles saves consumers approximately $95 million per year. Thus, this exemption improves the overall cost-effectiveness of the smog inspection program.

The 1973 and older vehicle exemption, on the other hand, does impact the fleet average emission rate. As seen in Table VI-4, exempting the approximately 500,000 pre-1974 vehicles reduces the effectiveness of the Enhanced I/M program. For hydrocarbons, including these older vehicles would increase the effectiveness of the program by about 7 percentage points. The impact on NOx is much smaller – about a 2 percentage point increase in program effectiveness – because the older vehicles have less refined NOx control systems.

Table VI-4
Effect of to Removing Vehicle Exemptions[1,2,3]
on Program Effectiveness

VEHICLE EXEMPTION SCENARIOS	HC_{total}	NOx
Current Program	68%	51%
1973 & Older *Not* Exempt (add 500,000 vehicles to program)	75%	53%
4-Yr & Newer *Not* Exempt (add 3.8 million vehicles to program)	68%	52%

[1] Includes both exhaust and evaporative hydrocarbons.

[2] All scenarios shown are for NOx cut points at current levels.

[3] Note that the effects shown in this table are for the Enhanced I/M program. Chapter V, Section B.4 describes why the 1997 legislative changes cause no net loss in HC or NOx emission reductions from the 90 Basic I/M program.

The significant impact of including older vehicles should come as no surprise since older cars continue to contribute a disproportionate amount of emissions, despite their relatively low numbers and use. For example, the average emissions from an exempted 1966 vehicle (before a smog inspection) are 8.62 grams/mile HC and 1.86 grams/mile NOx (see Table III-3). Whereas, the non-exempt 1974 vehicle emissions are 9.05 grams/mile HC and 3.16 grams/mile NOx *before* inspection; these 1974 vehicles are repaired to 6.82 g/mi HC and 3.17 g/mi NOx. As shown, the potential HC emission reductions from these older vehicles are substantial. In addition, unlike the new car exemption, the old car exemption*r ed uces the cost effectiveness* of the smog inspection program by removing vehicles from the program which have relatively high failure rates, high net emissions reductions for each vehicle repaired, and relatively low repair cost.

It should be noted that the impact of exempting approximately 500,000 pre-1974 vehicles would diminish over time due to vehicle retirement. However, in the year 2003, the old car exemption changes from 1973 and older vehicles to *any vehicle over 30 years old*. This "rolling exemption" essentially institutionalizes the loss in emission reductions caused by the old car exemption. If the rolling exemption were repealed, as pre-1974 vehicles represent an ever smaller part of the fleet through retirement, the impact of exempting these vehicles would become negligible.

There are two approaches to "recover" the lost emission benefits: repeal the 1973 and older vehicle exemptions, or repeal the "rolling exemption." Since the pre-1974 vehicles have been exempted since 1997, reintroduction of these vehicles into the biennial inspection cycle might result in relatively high failure rates and associated high repair costs. In addition, consumers owning pre-1974 vehicles might feel like something has been taken away from them and strongly oppose the change. On the other hand, repeal of the "rolling exemption" might not generate the same level of opposition because the vehicles that are affected (1974 and newer) are currently included in the biennial inspection cycle. Because they have not been exempted yet, nothing would be "taken away" by repealing the rolling exemption.

C. Comprehensive Evaporative System and Liquid Leak Check

As previously noted in this report, the U.S. EPA benchmark program included a "pressure/purge test" of the evaporative emission control system. The 1994 SIP included emission reductions modeled based on a gas cap/helium test at least equivalent in performance to the U.S. EPA pressure/purge test. However, at the present time, such a test is not practical, and in California only a gas cap pressure test is conducted. As a result, the current enhanced program's evaporative emissions benefits are short of those envisioned in the SIP.

A comprehensive evaporative system and liquid leak check/inspection element could be developed and implemented as a new part of the Smog Check program. To minimize the inconvenience to consumers, this type of inspection could be required only for vehicles past a specific age (which would be chosen based on field studies conducted by BAR). The first steps would be to implement a visual check for liquid leaks and conduct a pilot program to assess the costs and benefits of a more comprehensive effort. We have not yet quantified the likely emission reductions, but believe a comprehensive effort could substantially increase air quality benefits and move the program closer to the SIP goal.

D. Other Options

This draft report focuses on the key options we have identified to increase the program benefits, but does not attempt to present a comprehensive analysis of *all* possible program alternatives. Most notably, we made no attempt to analyze the effectiveness of specific program elements such as the High Emitter Profile or the relative performance of the various station types, i.e., test-only versus test and repair (or gold shield, etc.).

A very recent BAR report entitled “Smog Check Station Performance Analysis (April 25, 2000)” indicates that vehicles inspected at Test-Only stations account for greater emission reductions than vehicles inspected at Test and Repair facilities. The report concludes that additional benefits could be gained if the percentage of vehicles directed to test-only stations were increased. ARB only recently received this information and is still reviewing the analysis. Based on further analysis and comments received from the public, we may add additional options to increase program effectiveness to the final version of this report.